

## Abstract

A micro electron gun that is capable of extracting electrons from a semiconductor utilizing a quantum size effect and that can be mounted individually for each of pixels is disclosed, as well as a picture display apparatus using such electron guns which is high in quantum efficiency, of high brightness and thin, as well as methods of manufacture thereof. Conduction electrons from a n-type semiconductor substrate (2) are accelerated under an electric field through a layer or layers (4) of quantum size effect micro particles (3) formed on surfaces of the n-type semiconductor substrate (2) and passed therethrough without undergoing phonon scattering, so that they when arriving at an electrode (5) may possess an amount of energy not less than the work function of the electrode (5) and are thus allowed to spring out into a vacuum. Such a quantum size effect micro particle (3) comprises a micro particle of a single crystal semiconductor in a nanometer order having electron energy levels made so discrete that no phonon scattering is brought about, and on its surface area an insulator so thin that an electron is capable of tunneling therethrough.